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Effect of High Pressure on the Electronic Structure of Rubidium Evidenced from Synchrotron X-ray Absorption and Diffraction Studies

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It's well known that pressure can be used to tune the electronic structure of elements such that they exhibit altered reactivity and can form new compounds. The fundamental change in the electronic structure of alkali metals upon compression has been proclaimed in many works. It has been established that energies of s levels in these metals increases more rapidly under pressure than those of d levels, leading to a transition to a bonding state that contains only d electrons. The new electronic state opens the possibility of the formation of novel compounds, e.g., alloys of alkali and transition metals. The latter are expected to form Lave's phases, which exhibit many interesting magnetic and electronic properties and considered for the potential use as hydrogen storage materials.

So, it becomes of great importance to perform studies on response of the electronic structure of alkali metals to applied pressure. We present the synchrotron x-ray absorption and diffraction studies on rubidium under high pressures to above 50 GPa. The results show, for the first time, the signatures of pressure induced electronic structure changes of an alkali metal. The simultaneous use of absorption and diffraction techniques provided an insight into electronic-structural interrelation for the case.